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Health-Related Quality of Life of Older Adults in Costa Rica as Measured by the Short-Form-36 Health Survey

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Abstract

Objective: To test the validity of a common measure of health-related quality of life (Short-Form-36 [SF-36]) in cognitively healthy older adults living in rural and urban Costa Rica. **Method:** Confirmatory factor analysis was applied to SF-36 data collected in 250 older adults from San Jose and Guanacaste, Costa Rica. **Results:** The best fitting model for the SF-36 was an eight first-order factor structure. A high correlation between the Mental Component Summary and Physical Component Summary scores was found. Region differences indicated that rural dwellers perceive a poorer health-related quality of life compared with the urban group. **Discussion:** Costa Rican older adults perceived health as a unidimensional construct. Age and urbanity of older adult Costa Ricans should be appreciated when trying to measure self-reported physical and mental health. Cultural context of the individuals should be considered when studying health-related quality of life.

Keywords

health-related quality of life, SF-36, Costa Rica, older adults, rural/urban differences

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The Short-Form-36 health survey (SF-36) is a factor-analytically derived measure of health-related quality of life (HRQOL; Ware & Sherbourne, 1992) created from a subset of items from the Medical Outcome Study Questionnaire (MOS; Stewart & Ware, 1992). The SF-36 items aggregate into eight scales (first-order factors): physical functioning (PF), bodily pain (BP), role limitations due to physical health problems (RP), general health (GH), role limitations due to emotional problems (RE), social functioning (SF), emotional well-being/mental health (MH), and energy/fatigue or vitality (VT). The eight subscales yield two second-order factors: the Physical Component Summary (PCS; PF, BP, RP, and GH) and the Mental Component Summary (MCS; RE, SF, MH, and VT; cf. Ware & Kosinski, 2001; Ware & Sherbourne, 1992).

Initially developed in the United States, the SF-36 was adapted and validated for international use by the International Quality of Life Assessment project (IQOLA; Ware & Gandek, 1998). The current version of the SF-36 (Version 2.0) was improved in 1996 with better instructions, scales of measurement, and item words while maintaining the composition of the scales (Ware, 1999). The improvements also included greater comparability to commonly used translations of the instrument and cultural adaptations that were based on Version 1.0, allowing for ease of comparison between the two versions to obtain information on HRQOL. The SF-36 is used in over 40 countries worldwide, including many Latin American countries (LAC; Ware & Gandek, 1998).

The Spanish version of the SF-36 was originally adapted by Alonso, Prieto, and Anto (1995) in general adult population from Spain and has been widely used in this country to study HRQOL in different diseases

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(Alonso et al., 1998; Failde & Ramos, 2000; Sánchez et al., 2012). Further research examining the psychometric properties of this instrument have been conducted in LAC, such as Brazil (Assumpcao et al., 2010; Gomes-Teixeira et al., 2015; Oliveira, Costa, Manzoni, & Cabral, 2014), Argentina (Augustovski, Lewin, Garcia-Elorrio, & Rubinstein, 2008), Mexico (López-Pérez et al., 2014; Martínez-Hernández, Segura-Méndez, Antonio-Ocampo, Torres-Salazar, & Murillo-Gómez, 2010; Zuniga, Carrillo-Jimenez, Fos, Gandek, & Medina-Moreno, 1999), Chile (Lera, Fuentes-Garcia, Sanchez, & Albala, 2013), Peru (Salazar & Bernabe, 2015), and Colombia (Arango-Lasprilla, Krch, Drew, De Los Reyes Aragon, & Stevens, 2012; Garcia, Vera, & Lugo, 2014). These studies have examined the psychometric properties of this instrument with either descriptive or theory-driven (i.e., a priori) statistical procedures.

Studies using descriptive statistical procedures have mostly focused on analyzing the validity and reliability of the SF-36 by testing its internal consistency with Cronbach's alpha (Assumpcao et al., 2010; Augustovski et al., 2008; Garcia et al., 2014; Jordan-Marsh, Cody, Silverstein, & Garcia, 2008; Martínez-Hernández et al., 2010; Zuniga et al., 1999). The internal consistency varied among these studies, with coefficients ranging from low (Jordan-Marsh et al., 2008) to moderate and strong in adult samples of Argentina (Augustovski et al., 2008), Mexico (Martínez-Hernández et al., 2010; Zuniga et al., 1999), and Peru (Salazar & Bernabe, 2015). One study focused more on examining the predictive validity of the instrument in Spanish-speaking individuals (Assumpcao et al., 2010). Other studies did not assess the psychometric properties of the SF-36 in their samples (see Arango-Lasprilla et al., 2012; Garcia et al., 2014; López-Pérez et al., 2014). The cumulative findings from these studies suggest that the instrument overall has a moderate to strong internal consistency. However, Cronbach's alpha is only an indicator of the closeness of the items in a scale but does not inform about its dimensionality or structure (T. A. Brown, 2014), that is, this measure of internal consistency does not allow for examining the structural validity of the SF-36 within each country.

Studies using theory-driven statistical procedures, such as confirmatory factor analyses (CFA), examined the measurement invariance of the instrument by looking at the relationship between the observed measures (i.e., behavioral ratings) and latent variables (i.e., construct measured), and testing how well measurement models generalize across groups (T. A. Brown, 2014). The original scoring algorithm for the SF-36 proposes an orthogonal (uncorrelated) model indicating that the two higher order constructs are independent (Ware & Sherbourne, 1992). This algorithm has been found problematic as it produces negative coefficients in some scales and negatively weighted scales of one component explaining the variance of the other component, suggesting an interdependence between PCS and MCS (Taft, Karlson, & Sullivan, 2001). Other studies have found better models using an oblique solution (Hann & Reeves, 2008; Laucis, Hays, & Bhattacharyya, 2015; Simon, Revicki, Grothaus, & Vonkorff, 1998). Thus, continued theory-driven research is important on this instrument to gain an accurate understanding of measurement invariance and cross-cultural factors that contribute to these differential findings.

Theory-driven statistical procedures to analyze the psychometric properties of the SF-36 have been conducted worldwide (Ware & Gandek, 1998). Although limited, the studies from Spain and LAC have been informative to our understanding of cross-cultural factors of HRQOL in Spanish-speaking populations. To our knowledge, five studies have used CFA statistical procedures to examine the psychometric properties of the SF-36 and found mixed results (Ayuso-Mateos, Lasa, & Vazquez-Barquero, 1999; Failde & Ramos, 2000; Lera et al., 2013; Peek, Ray, Patel, Stoebner-May, & Ottenbacher, 2004; Salazar & Bernabe, 2015). Most studies found that the first-order domains demonstrate some problems comparatively with the original factor structure (Ware & Sherbourne, 1992). For example, Ayuso-Mateos et al. (1999) found that five first-order factors best fit the model in their adult sample in Spain, while a similar study in Spain found that all eight first-order factors load except for some problematic items on the mental health domain (Failde & Ramos, 2000). Similarly, Peek et al. (2004) found that the RE domain was not loading as proposed in the original factor structure in their sample of Mexican Americans. The Peruvian study used CFA and found the model with eight first-order factors and two second-order factors had acceptable fit (Salazar & Bernabe, 2015). The Chilean study by Lera and colleagues (2013) used principal components factor analysis, which forces items to load onto a construct, with an orthogonal solution. Their findings supported two higher order factors (MCS and PCS) with GH loading on MCS (Lera et al., 2013). The Chilean study is the only study in LAC focusing on an older adult sample. The factor structure of the SF-36 should be examined to explore its measurement invariance and test its construct validity in each country interested in its clinical application. Of interest in this study is to examine the factor structure of the SF-36 in a sample of Costa Rican older adults.

Although most LAC share cultural-related characteristics and Spanish as their primary language, the differences between countries in older adults' health status and self-reported health found in the Health, Well-Being, and Aging studies (SABE), led us to believe older adults' HRQOL should be examined within each country's cultural world (see Palloni & McEniry, 2007; Zunzunegui, Alvarado, Beland, & Vissandjee, 2009). To our knowledge, the present study is the first one in the Central America region using the SF-36 and examining its factor structure in a sample of cognitively healthy older adults. There is no research to date that

Table 1. Participant Descriptive Statistics.

	Urban (n = 168)		Rural (n = 71)		Total (n = 250)	
	n	%	*n*	%	*n*	%
Gender						
Male	45	26.8	14	19.7	60	24.0
Female	123	73.2	57	80.3	186	74.4
Missing	—	—	—	—	4	1.6
Highest level of education						
Incomplete elementary	15	8.9	17	23.9	34	13.6
Elementary	19	11.3	7	9.9	26	10.4
Incomplete high school	17	10.1	10	14.1	29	11.6
High school	20	11.9	9	12.7	29	11.6
Incomplete university	33	19.6	4	5.6	37	14.8
University	64	50.0	24	33.8	91	36.4
Missing	—	—	—	—	4	1.6
	M	*SD*	*M*	*SD*	*M*	*SD*
Age	67.54	5.67	69.85	6.25	68.28	5.98
Mini-Mental Status Examination	29.09	1.26	27.83	1.67	28.69	1.51

Note. 11 respondents did not specify geographical region.

has used theory-driven statistical approaches to study perception of health and well-being as measured by the SF-36 in Costa Rica. The purpose of this study is to examine the factor structure of the SF-36 in a sample of Costa Rican older adults followed by a model that evaluates the effects of personal characteristics in their HRQOL.

Method

The Epidemiology and the Development of Alzheimer's Disease in Costa Rica (EDAD) is a large study of Latino cognitive aging conducted in collaboration with the Universidad de Costa Rica (UCR), the University of Kansas (KU), and the University of California at Davis School of Medicine (UCD). The EDAD was designed to assess functionality in domains of cognition, personality, psychosocial behaviors, physical health, and diet in older adults residing in rural and urban areas of Costa Rica. The overarching goal of this research project was to compare functional abilities of older adults in rural and urban residences on the various domains. Participants were recruited from the Institutional Program for the Older Adults of the University of Costa Rica, the Costa Rican Gerontology Association, the Golden Citizen Program of the Costa Rican Social Security Bureau, as well as community-dwelling older adults. Both the UCR and KU institutional review boards approved the study. All participants consented prior to taking part in this research study.

Participants

Participants included 250 Costa Rican older adults between the ages of 60 and 85 from the Greater Metropolitan Area of San Jose (urban region) and the Guanacaste province (rural region). As shown in Table 1, 74% of the sample were females and the ratio of female to male was relatively similar in urban and rural regions (~3:1 female to male ratio). Participants had a mean age of 68.28 years (SD = 5.98). In addition, 61% endorsed hypertension and 18% endorsed a diagnosis of diabetes; both conditions were reported to be well managed with medication. Eligibility requirements for all participants included normal to corrected vision and hearing, no present cognitive impairment as measured by the Mini-Mental Status Examination (MMSE > 23; Blesa et al., 2001; Folstein, Folstein, & McHugh, 1975), and regimented adherence to medication (within 30 days of testing). Participants were excluded for a past or current history of clinically significant major psychiatric disorder or significant psychiatric symptoms, clinically evident stroke, brain trauma, neurocognitive disorder, clinically significant infection within the last 30 days, history of drug or alcohol abuse or dependence within the past 2 years, and significant pain or musculoskeletal disorder.

Procedure

Each participant completed the Spanish version of the SF-36 Health Questionnaire as part of a larger survey on health behaviors. The administered version is in coordination with the version adapted and translated by Alonso, Prieto, and Anto (1995) to measure HRQOL. Statistical analyses of the Spanish version indicated an acceptable internal consistency, with Cronbach's alpha ranging from .70 to .90 (Alonso et al., 1995; Ayuso-Mateos et al., 1999). The Spanish version of this scale has been shown to be valid in Hispanic populations (Arango-Lasprilla et al., 2012; Augustovski et al., 2008; Garcia et al., 2014; López-Pérez et al., 2014; Martínez-Hernández et al., 2010; Salazar & Bernabe, 2015; Zuniga et al., 1999).

Data were collected with three-form planned missing design, where each subject answered two thirds of the items of the SF-36 scale (Graham, Hofer, & MacKinnon, 1996; Graham, Taylor, Olchowski, & Cumsille, 2006). The three-form planned missing design reduces subject burden and fatigue, increasing reliability and power. Due to the planned missing data design, multiple imputation was used to properly handle missing data (Enders, 2010). The data were imputed as ordinal keeping the categorical scale intact.

Statistical Analyses

We examined the underlying dimensions (i.e., factors) and the item–factor relationship (i.e., factor loadings) of the SF-36 Questionnaire in a sample of Costa Rican older adults using CFA. Relevant items were reverse scored and multiple imputation was implemented using the Bayes estimator in Mplus 7.2 (Muthén & Muthén, 1998-2012) to generate 100 imputed data sets. Three alternative factor structures of the SF-36 were tested. The first model was with eight first-order factors corresponding to the eight scales (PF, RP, BP, GH, VT, SF, RE, MH) and no higher order factors. The second model added to Model 1 two higher order factors represented by the PCS (PF, RP, GH, VT) and the MCS (VT, SF, RE, MH). The third model added to Model 1 one higher order factor representing overall health (PF, RP, BP, GH, VT, SF, RE, MH).

All factor models were identified and evaluated using the parameters described in this section. The response items on the SF-36 Questionnaire are categorical, so we used the robust weighted least squares (WLSMV) in Mplus 7.2 (Muthén & Muthén, 1998-2012) to estimate model parameters as this is the most appropriate estimator for categorical data (Curran, West, & Finch, 1996; Hu, Bentler, & Kano, 1992). Latent variables were defined by the corresponding item of the SF-36 Questionnaire. Model identification was set using a fixed factor variance method so that the latent mean is fixed to 0 and latent variance is fixed to 1. The higher order models utilized marker variable for the lower order factors and fixed factor for the higher order factor(s). Marker variable fixes the first item to 1 and freely estimates the factor variance. Factor loadings between measured indicators and between latent variables were allowed to vary without constraint.

Model fit was evaluated on overall goodness of fit. Chi-square analyses were conducted to evaluate overall goodness of model fit (χ^2) with nonsignificant values indicating poor model fit. Additional model fit indices, such as comparative fit indices (CFIs) and root mean square error of approximation (RMSEA) were also evaluated for greatest specification of overall model fit. CFI values equal to greater than 0.95 and RMSEA values equal to or smaller than 0.05 indicate good model fit (Hu & Bentler, 1999), with CFI greater than 0.90 and RMSEA less than 0.08 considered acceptable (T. A. Brown, 2014). We did not conduct model modifications to assess for model improvement fit to data because the goal of this project was to determine if the factor structure of the SF-36 could be replicated in our sample of cognitively healthy older adults in Costa Rica.

In subsequent analyses, region, age, and education were added as covariates and the a priori α was set to .05. Region was implemented as a dummy variable predictor of latent constructs that were scaled to a mean of 0 and *SD* 1, and the coefficients were automatically interpretable as latent *d* effect sizes. Urban was set as the reference group, with differences estimated for rural participants. Covariate for education was included in the analyses as the highest level of completed education with five dummy variables (elementary school, incomplete high school, high school, incomplete university, and university) compared with incomplete elementary school. Furthermore, age was mean-centered and then entered as a covariate.

Results

Preliminary Analyses

Based on the proposed factor structure, all combinations of items within a factor were placed in contingency tables. Responses were inspected to look for sparseness of responses in some answer choice categories and lack of variance in pairs of responses. From the item inspection, we decided to omit Item 12 (limits in "bathing or dressing yourself") due to a large percentage of participants answering "no, not limited at all," and Item 15 ("were limited in the kind of work or other activities") for having identical answers to Item 13 ("cut down the amount of time you spent on work or other activities"). Furthermore, the first two response choices were collapsed into a single choice for certain questions due to too few selected responses across the two choices. On the GH domain, Items 33 to 36, response choices "definitely true" and "mostly true" were collapsed. On the Vitality and Mental Health domain, Items 23 to 31, response choices "all of the time" and "most of the time" were collapsed.

After removing Items 12 and 15, and collapsing categories, CFA model fitting was conducted (Bentler & Mooijaart, 1989; Jöreskog & Sörbom, 1996; MacCallum, Browne, & Cai, 2006). Each of the eight factors proposed in the original model of the SF-36 fit well, but their loading onto higher order latent constructs was highly correlated, introducing instability into the CFA, nested model testing procedure. The first pair of problem factors was RP and RE. Each factor is composed of questions following a prompt about problems in the last 4 weeks, and the first two questions in each set have

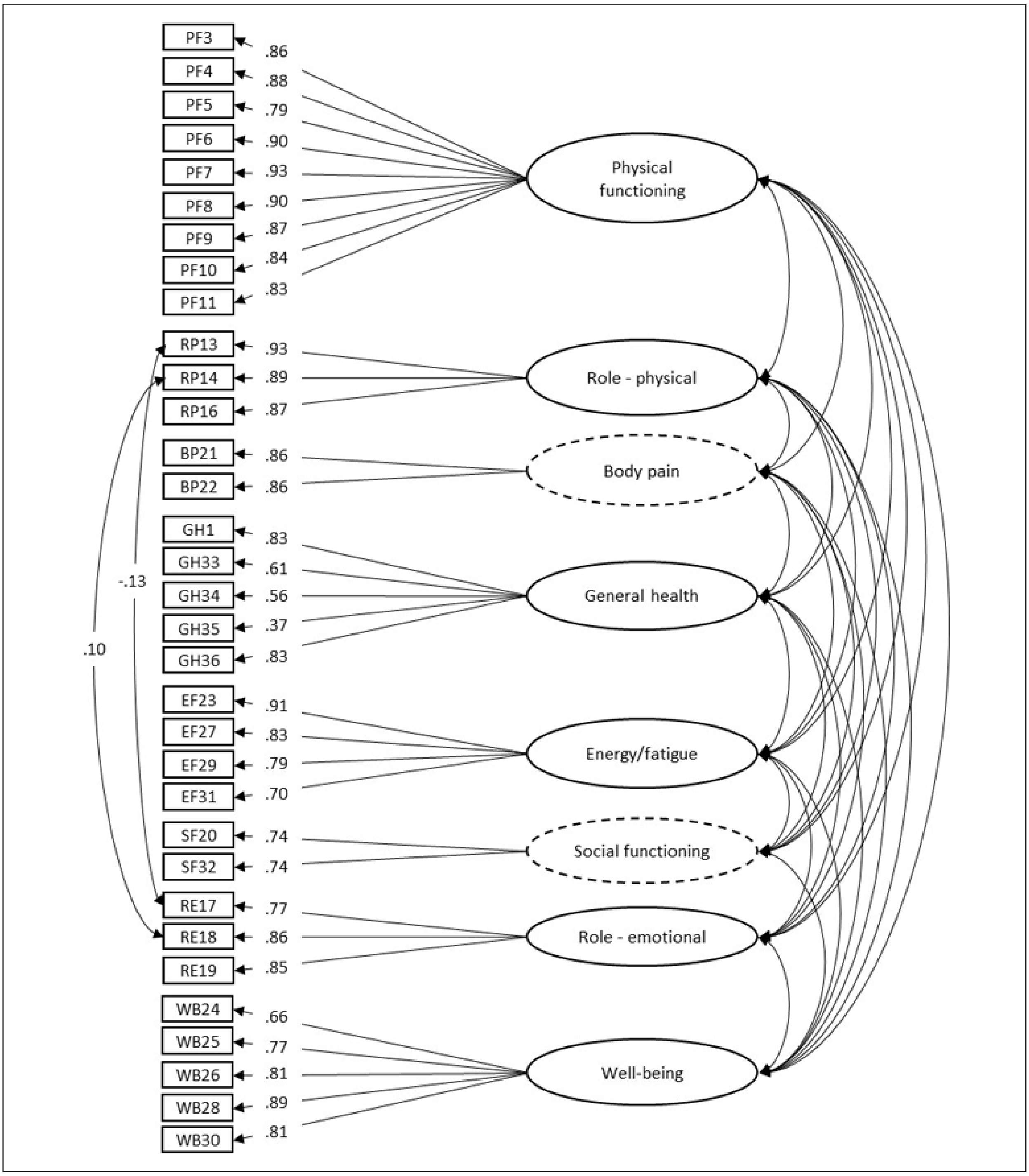

Figure 1. Final model with factor loadings.
Note. The dashed ovals for BP and SF reflect that the model converged without warnings if one of the two constructs was omitted, but the factor loadings did not change. Although not represented in the diagram, error was estimated for all indicators. Items 12 and 15 were omitted from the analyses (see "Results" section). The latent covariances are listed in Table 3.

similar meaning (i.e., "cut down the amount of time" and "accomplished less"). As shown in Figure 1, correlation residuals were added between Questions 13 and 17 and between Questions 14 and 18. This minor change reduced the correlation between RP and RE to acceptable levels. The second pair of problem factors was BP and SF, so each model was reestimated twice, once without BP and once without SF. Dropping either factor added stability to the model but did not change the general results, as shown in Tables 2 and 3.

As shown in Table 1, participants from the urban region (n = 168) had a mean age of 67.54 years (SD = 5.67) and those residing in the rural area (n = 71) a mean age of 69.85 years (SD = 6.25), being statistically

Table 2. Fit Indices for the Three Factor Structures and All Models at Each Stage.

	χ^2	χ^2 *SD*	*df*	RMSEA	RMSEA *SD*	CFI	CFI *SD*	TLI	TLI *SD*
Model 1. First-order factors									
All	996.62	45.95	467	0.067	0.003	0.935	0.006	0.926	0.007
Omit BP	886.05	45.28	412	0.068	0.003	0.937	0.007	0.929	0.007
Omit SF	893.04	45.16	412	0.068	0.003	0.937	0.006	0.929	0.007
Model 2. Two higher order factors									
All	1,141.58	51.64	485	0.074	0.003	0.919	0.007	0.912	0.007
Omit BP	1,016.75	49.66	424	0.075	0.003	0.922	0.007	0.914	0.008
Omit SF	1,008.93	50.02	424	0.074	0.003	0.924	0.007	0.916	0.008
Model 3. One higher order factor									
All	1,173.17	53.20	486	0.075	0.003	0.916	0.008	0.908	0.008
Omit BP	1,061.37	51.99	425	0.077	0.003	0.916	0.007	0.908	0.008
Omit SF	1,050.52	52.10	425	0.077	0.003	0.918	0.007	0.911	0.008

Note. Because robust weighted least squares estimator was used with imputed data, available model fit statistic are available as a point estimate and standard deviation across successful estimations. RMSEA = root mean square error of approximation; CFI = comparative fit index; TLI = Tucker–Lewis index; BP = bodily pain; SF = social functioning.

Table 3. Correlations Between Constructs for Model 1 Based on All or Subset of First-Order Factors.

	1.	2.	3.	4.	5.	6.	7.	8.
All 8 factors								
1. Physical functioning	1							
2. Role limits—Physical problems	.66	1						
3. Bodily pain	.62	.74	1					
4. General health	.67	.59	.59	1				
5. Energy/fatigue	.58	.55	.61	.65	1			
6. Social functioning	.65	.86	**1.04**	.89	.90	1		
7. Role limits—Emotional problems	.71	.95	.86	.56	.70	.94	1	
8. Emotional well-being	.34	.52	.62	.64	.77	.94	.77	1
No bodily pain								
1. Physical functioning	1							
2. Role limits—Physical problems	.66	1						
3. Bodily pain	—	—	—					
4. General health	.67	.60	—	1				
5. Energy/fatigue	.58	.56	—	.65	1			
6. Social functioning	.65	.86	—	.89	.90	1		
7. Role limits—Emotional problems	.70	.96	—	.56	.70	.94	1	
8. Emotional well-being	.34	.52	—	.64	.77	.94	.77	1
No social functioning								
1. Physical functioning	1							
2. Role limits—Physical problems	.66	1						
3. Bodily pain	.62	.74	1					
4. General health	.67	.59	.59	1				
5. Energy/fatigue	.58	.55	.61	.65	1			
6. Social functioning	—	—	—	—	—	—		
7. Role limits—Emotional problems	.71	.95	.86	.56	.70	—	1	
8. Emotional well-being	.34	.52	.62	.64	.77	—	.77	1

For all correlations, $p < .001$.
Note. Bolded values indicate latent correlations > 1.00, a condition that produced a non-positive definite result.

different, $t(237) = -2.79$, $p < .001$. The mean level of education for participants in the urban area ($M = 14.18$, $SD = 6.21$) was significantly higher than that of their counterparts in the rural region ($M = 10.27$, $SD = 5.82$), $t(234) = 4.51$, $p < .01$. These results suggest that age and level of education could be potential extraneous variables and therefore were added as covariates in our CFA models. Additional chi-square analyses did not show a significant difference between rural and urban participants for hypertension, $\chi^2(1, N = 235) = .320$, $p = .57$, $\phi = .037$, and diabetes, $\chi^2(1, N = 235) = 1.41$, $p = .24$, $\phi = .07$.

Model Comparison

Our results show that the observed data fit the eight first-order factors model well and that the inclusion of higher order factors did not significantly improve fit. Neither the two- nor the one higher order factor model fits the observed data appreciable better. Summary of model fit statistics are in Table 2 for the three alternate factor structure models of the SF-36 Questionnaire from our analyses. As shown in Table 2, factor loadings of individual indicators (i.e., factors or domains) changed very little or not at all whether the domain of BP or SF was omitted or not for all models. The largest observed difference from one model to the next was within the confidence interval of the same estimate in the other two models. In reference to size of factor loadings, ideally all standardized factor loadings (λ) should exceed 0.70, indicating that more than half of the variance for each item is due to the factor. As shown in Figure 1 (depiction of Model 1), the factor loading for Question 35 ("I expect my health to get worse") was 0.37, well below 0.70, indicating that only 13.7% of its variance for this question was explained by GH. Examination of sample statistics showed that this item correlated highly (r = .53) with only one other question on the factor: Question 33 ("I seem to get sick a little easier than other people"). The other correlations ranged from .05 to .24. Factor loadings for three other items were less than 0.70, but the 95% confidence interval for those items contained 0.70. Those questions were 33 and 34 on GH and Question 24 on MH.

When the two higher order factors were introduced in Model 2, there was no impact on the factor loadings for the lower order factors with the exception of four domains (BP, SF, RP, and RE). The factor loadings for BP and SF changed slightly because these items were constrained to equality for identification purposes in the other models. However, as shown in Table 3, removal of either BP or SF did not change factor correlations for the lower order factors. Furthermore, PF was correlated at the same level with all other factors (those loading on PCS and MCS), except MH, and RP was highly correlated (r = .94) with RE. These statistical changes suggest cross loading between PCS domains and MCS domains. In order for higher order factors to improve model fit, the correlations between the Physical Health domains should be higher than with any Mental Health domain. This is not the case in these Latin American older adults. Due to the high cross loading of first-order factors when the higher order models were analyzed, Model 1, with no higher order factors, best represents HRQOL in our sample.

Furthermore, the estimates in Model 2 with eight first-order factors and two higher order factors produced a correlation between PCS and MCS that exceeded .84. Although the exact statistic differed slightly for each of the three models, the estimates for each model remained within the confidence interval of the other two models (i.e., correlation was still within confidence interval). In this sample, the correlation in the model with all eight first-order factors was .88 (SE = 0.03). The correlation was .85 (SE = 0.04) in the model without BP. The model without SF estimated a latent correlation of .86 (SE = 0.04). Regardless of model, the correlation between PCS and MCS was large.

Effects of Covariates (Region, Age, and Education)

Given the results from the independent samples t test, we examined the effects of region, age, and education as covariates in our models. These variables were added to the model selected as the better of the higher order models (Model 2, two higher order factors) and the first-order model with no higher order factor (Model 1) to estimate change in overall health.

Region. Region (urban or rural) was added first to Model 1. Overall health on all factors was lower for rural participants with standardized coefficients that ranged from −0.23 SDs on RP to −0.77 SDs for SF. The effects of region on RP and RE were not statistically significant based on Wald statistics with probability that exceeded .05, which indicated that there was no statistical difference between urban and rural participants on these two factors. All other first-order factors showed that there were statistically significant differences by region. Two models were estimated to determine if omission of a factor would change results, and the effects of region did not differ in models in which BP or SF were omitted. The full list of coefficients for models is provided in Table 4, which also contains the coefficients for the two higher order factors model (with all eight factors) to determine if there were PCS and MCS differences based on region.

In Model 2, the effect of region was quite large, similar to the results in Model 1. In the model with all eight first-order factors, participants' PCS in rural settings was 0.68 (SE = 0.18) standard deviations lower than their urban peers. MCS was 0.47 (SE = 0.17) standard deviations lower as well.

Age. In Model 1, statistically significant results were observed in PF, VT, and MH. The effect for age was negative, which indicated that, for every year increase in age, health ratings decreased with changes interpreted in terms of standard deviations on the factor scores. The largest effect was for PF (β = –.04, SE = 0.01). Both VT and MH decreased 0.03 standard deviations (SE = 0.01) for every 1-year increase in age. In Model 2 (two higher order factors), the effects of age were significant in PCS (β = –.03, SE = 0.01) but not MCS (β = –.02, SE = 0.01), as shown in Table 4.

Table 4. Effect of Age and Rural Geographic Location With Urban Participants as Reference Group.

	β	*SE*	Wald	*p*
Age				
Model 1—First-order factors				
Physical functioning	−.04	0.01	−3.08	.002***
Role limits—Physical problems	−.02	0.02	−1.18	.239
Bodily pain	.00	0.02	0.20	.839
General health	−.01	0.01	−0.44	.657
Energy/fatigue	−.03	0.01	−2.05	.040*
Social functioning	.00	0.02	−0.06	.954
Role limits—Emotional problems	−.01	0.02	−0.85	.397
Emotional well-being	−.03	0.01	−2.08	.038*
Model 2—Two higher order factors				
Physical health	−.03	0.01	−2.11	.035*
Emotional health	−.02	0.01	−1.81	.071*
Rural				
Model 1—First-order factors				
Physical functioning	−.57	0.16	−3.51	.000***
Role limits—Physical problems	−.23	0.23	−1.04	.299
Bodily pain	−.46	0.18	−2.50	.012*
General health	−.67	0.18	−3.72	.000***
Energy/fatigue	−.37	0.17	−2.16	.030*
Social functioning	−.77	0.25	−3.11	.002**
Role limits—Emotional problems	−.26	0.21	−1.22	.222
Emotional well-being	−.40	0.18	−2.25	.025*
Model 2—Two higher order factors				
Physical health	−.68	0.18	−3.86	.000***
Emotional health	−.47	0.17	−2.75	.006**

*$p < .05$. **$p < .01$. ***$p < .001$.

Education. The results listed in Table 5 indicated mean differences on SF-36 responses changed little based on level of completed education, with one exception. In Model 1, participants with incomplete high school rated their health lower on VT (β = –.59, *SE* = 0.30), SF (β = –.95, *SE* = 0.41), and MH (β = –.71, *SE* = 0.29), all emotional health domains. Likewise, in Model 2, MCS rating were significantly different for those same participants (β = –.74, *SE* = 0.29). All of these statistically significant results had $p < .05$. These findings suggest that education does not have overall significant impact on perception of HRQOL, although some slight differences on emotion-based domains were noted.

Summary of Results

Analyses identified two questions that could not be included in the models, namely, Items 12 and 15, as well as questions with sparse responses at one end of response choices. After removal of these indicators and collapsing of categories, high latent correlations were problematic for role limits (RP and RE) though correlated residual added due to similar wording and closeness of questions on the measure reduced the correlation to acceptable levels for estimation. All models were estimated 3 times to examine the factor structure with all eight factors and then without SF or BP. Estimates were affected very little by the omission of one of those factors, and final CFA results indicated that the best fit model was the model without higher order factors. The health ratings differed by region, with lower physical and mental health reported by participants from rural settings. Older age also influenced participants' perception of their HRQOL. Finally, no health differences were found in the completed educational levels.

Discussion

The purpose of the present study was to assess the factor structure of the SF-36 in a sample of cognitively healthy older adults from Costa Rica. Based on modification indices, we revised the current model and evaluated alternative factor structures. Our findings show that the best fitting model of the SF-36 was the one with the eight first-order factor structure, indicating that the same first-order factor structure found to be valid for English (Ware & Sherbourne, 1992) and Spanish speakers (Spain: Alonso et al., 1995; Peru: Salazar & Bernabe, 2015; Chile: Lera et al., 2013) was also valid in this sample of Central Americans. The original empirical model of the SF-36 with eight first-order factors is supported in our sample of Costa Rican older adults.

Table 5. Mean Health Differences and Standard Errors for Highest Completed Education Level as Compared With Incomplete Elementary School.

	Elementary school	Incomplete high school	High school	Incomplete university	University
Model 1—First-order factors					
Physical functioning	0.24	−0.28	−0.32	0.31	0.22
	(0.29)	(0.28)	(0.28)	(0.28)	(0.23)
Role limits—Physical problems	0.14	−0.22	−0.25	0.44	0.10
	(0.42)	(0.36)	(0.38)	(0.44)	(0.31)
Bodily pain	0.39	−0.40	0.38	0.40	0.33
	(0.31)	(0.30)	(0.32)	(0.31)	(0.25)
General health	−0.19	−0.29	−0.22	0.05	0.16
	(0.31)	(0.31)	(0.30)	(0.29)	(0.25)
Energy/fatigue	0.06	−0.59*	−0.39	−0.10	−0.22
	(0.28)	(0.30)	(0.30)	(0.28)	(0.25)
Social functioning	−0.23	−0.95*	−0.12	0.28	0.16
	(0.44)	(0.41)	(0.45)	(0.43)	(0.37)
Role limits—Emotional problems	0.25	−0.49	−0.11	0.40	0.22
	(0.40)	(0.36)	(0.39)	(0.45)	(0.32)
Emotional well-being	−0.05	−0.71*	−0.13	−0.32	−0.06
	(0.30)	(0.29)	(0.29)	(0.29)	(0.24)
Model 2—Two higher order factors					
Physical health	0.20	−0.38	−0.23	0.35	0.27
	(0.32)	(0.30)	(0.31)	(0.30)	(0.24)
Emotional health	0.02	−0.74*	−0.26	−0.07	−0.04
	(0.31)	(0.29)	(0.31)	(0.29)	(0.25)

Note. Standard errors are listed below the estimate and enclosed in parentheses.
*$p < .05$.

As part of the model revision of the confirmatory procedure, we tested the seven first-order models that omitted BP or SF, which did not result in a superior factor model to the one with eight factors. We found that the eight-factor model was the most robust model, even when the two higher order factors (i.e., MCS and PCS) were included. These findings suggest that Costa Rican older adults' HRQOL is better characterized by the scores of the eight domain scales than the two higher order component scores.

The Eight-Factor Structure of the SF-36

As we explained in the "Results" section, the specified model resulted in omitting some items, collapsing answer choices, and testing alternative models to add stability to the model. The source of instability came from the low variability in some item responses (i.e., Item 12), multicollinearity found on pairs of items (i.e., Items 13 and 15), and first-order factors (i.e., BP and SF). Recall that factors are best identified when multiple items are used in composite to define them. In the case of BP and SF, there were only two items that defined each factor. Thus, the item density of these factors was low. Furthermore, each contributing item had similarly worded descriptions. The item conceptual and grammatical overlap was not distinct enough for our Costa Rican sample to make fine discerned judgments leading to the items' multicollinearity. Other studies have similarly found that these same constructs (BP and SF) have poor psychometric properties (i.e., low Cronbach's alpha) and they do not clearly discriminate on which second-order factor they load (see Alonso et al., 1998; Ayuso-Mateos et al., 1999; Jordan-Marsh et al., 2008; Keller et al., 1998; Kelly et al., 2015; Oliveira et al., 2014; Peek et al., 2004; Y. Zhang, Qu, Lun, Guo, & Liu, 2012).

An alternative explanation to Costa Rican older adults' perception of their HRQOL can be formulated from a cultural perspective. Our findings of multicollinearity between the BP and SF factors could be indicative of the cultural construction Costa Rican older adults have on pain perception and social functioning. Based on Yiengprugsawan, Welsh, and Kendig's (2018) finding of a positive association between social connectedness and good self-rated health in mid- and later life, and on Biesanz, Biensanz, and Biesanz's (1999) description of older generations of Costa Ricans as work-oriented and community-involved citizens, it is possible that Costa Rican older adults' social and work-related activities positively influence their views on pain, physical, and/or emotional health–related problems. This interpretation would support findings from experimental studies in which distractibility, cognitive reappraisal (Wiech, 2016), and social support (J. Brown, Sheffield, Leary, & Robinson, 2003) reduces pain perception.

HRQOL as a Unidimensional Construct

Costa Rican older adults perceive health as a unitary construct, and their HRQOL is better characterized by analyzing the eight first-order factor scores only. The high correlation between PCS and MCS advises there was low discriminant validity between the physical and mental health composites, indicating that these constructs are not discriminated in this sample of Latin Americans (T. A. Brown, 2014). The cross-loadings of high correlation between domains of PCS and of those that load on to MCS suggest that even the relationship between the first-order domains was not clearly differentiated as purely physical or mental. These results converge with other reports in LAC, where high correlations between the SF-36 components have also been reported (see Salazar & Bernabe, 2015; Tucker, Adams, & Wilson, 2013).

The concepts of health and HRQOL are social constructions (see Olafsdottir, 2013) that are embedded within a particular social context. This perspective of the social construction of health could explain the nondistinction between a mental and a physical component of the SF-36 in our sample. Costa Rican older adults perceive their health as an overlapping single construct, not as two Cartesian discrete constructs in which the body and the mind are separate entities. Costa Ricans' perception of their HRQOL is consistent with the dynamic relationship between mental and physical health found in aging studies (Ohrnberger, Fichera, & Sutton, 2017); and with the World Health Organization's (WHO) view on health: "there is no health without mental health" (WHO, 2004, p. 10). The joint effect of social, physical, and mental health on HRQOL has been evidenced in studies conducted outside the Latin American region. For example, X. Zhang and colleagues (2018) found that different lifestyle factors (e.g., diet, sleep, exercise, labor, and leisure time) contributed to the perception of HRQOL in Chinese older adults.

HRQOL as a Function of Sociodemographic Characteristics

HRQOL of Costa Rican older adults differed by region of residency. Those residing in rural Costa Rica reported overall lower HRQOL compared with those living in urban Costa Rica. These geographical differences in health perception highlight that impact of social determinants of health as a fundamental cause of health inequalities. According to the WHO (n.d.), the social determinants of health consider the "conditions in which people are born, grow, live, work and age." The fundamental cause of health inequalities is more specific in explaining that socioeconomic status (SES) can open or limit the access to resources that can prevent diseases or minimize its consequences (see Phelan, Link, & Tehranifar, 2010). These theories explain the effect of region on Costa Rican's HRQOL we found in this study.

Costa Rica has superior health indicators compared with its Central American neighbors; however, significant health disparities within the country exist. Costa Rica is an LAC with a superior human development in the region (see the human development index from the United Nations Developmental Program [UNDP]), with a public health system (in Spanish: seguridad social) implemented on principles of social participation, solidarity, equity, and universality, which are financially mandatory, and with rural health programs such as the Community and Rural Health Program in Nicoya (Salas-Chavez, 2013). However, the inequalities within the country are moderately increasing (see UNDP), making health access difficult to reach in those provinces with lower social development (Castillo-Martinez, 2013). Rural Costa Rican older adults' lower perception of their HRQOL is a reflection of the health and sociocultural disparities in their surroundings. Health and quality of life are not dependent on individual effort.

From the SABE studies, we know that differences in self-reported health among Latin American older adults are associated with education and income inequalities (Palloni & McEniry, 2007). Specific to Costa Rica, Rosero-Bixby and Dow (2009) found that smoking and sedentary behaviors were more common among low-SES older adults, compared with those in the highest SES bracket. These studies support the view that the HRQOL disparities found in our study can be explained by the fundamental cause of health inequalities.

As expected, we found that age is related to Costa Ricans' view of HRQOL. Older participants reported having poorer PF, less energy, and lower emotional well-being. As age increased, reported health on these domains specifically was rated lower. It is important to note that age did not influence ratings on all domains of the SF-36. The association between age and HRQOL has been well documented and our results are consistent with those found in other studies (see Der-Martirosian, Kritz-Silverstein, & Barrett-Connor, 2010; Sullivan, Kempen, Van Sonderen, & Ormel, 2000). We want to highlight that even though poorer ratings of HRQOL on those three factors were related to participants' age, domains associated with perception of pain, social functioning, role limitations, and general health were not significantly rated lower as a function of age. Age should be considered when evaluating HRQOL in older adults.

Finally, our results showed no mean differences in HRQOL between the highest and lowest completed level of education (i.e., university completed vs. incomplete elementary). This finding is suggesting that the differences in HRQOL between the urban and rural regions are the result of other sociocultural disparities but not of education. Future studies should aim at exploring the characteristics that explain the urban and rural differences found in the Costa Rican older adult population.

Conclusion

Our study examined the factor structure of the SF-36 in a sample of Costa Rican cognitively healthy older adults and found that the eight-factor model describes better this population's HRQOL. In the model with two higher order factors, our findings show a high correlation between mental component and physical component scores, suggesting that these scores are not clearly distinguished as two separate constructs. Given the popularized use of the SF-36 in research and clinical settings, we strongly encourage consideration of the sociocultural context of Latin American older adults. We believe that researchers and clinicians should always be mindful of the underlying cultural values of health-related concepts (see Ngo-Metzger, Sorkin, Mangione, Gandek, & Hays, 2008). Those who use the SF-36 with Latin American older adults should use the mental and PCS scores with caution (see, Simon et al., 1998).

Validity studies of the SF-36 in Latin American older adult population are necessary for understanding of health perception of older adults within the region, and for developing country-specific scoring norms. In this effort, we recommend (a) testing measurement invariance with the specific populations of interest, (b) conducting preliminary analyses of items and distribution of responses to adjust properly the model specification step of the confirmatory process (see MacCallum, 2003), and (c) testing if changes on the structure of the BP and SF factors (i.e., expanding the items on each subscale) would result in improved model fit.

Overall, we examined the structural validity of the SF-36 and found the eight scales are valid constructs in our sample of cognitively healthy Costa Rican older adults. Our results support the use of the SF-36 in Latin American older adults. The interpretation of composite measures of physical health and mental health should be conducted with caution as they may not be distinctive in the way Latin Americans view health.

Declaration of Conflicting Interests

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References

Alonso, J., Prieto, L., & Anto, J. M. (1995). La versión española del SF-36 health survey. *Medicina Clinica*, *104*, 771-776.

Alonso, J., Prieto, L., Ferrer, M., Vilagut, G., Broquetas, J. M., Batlle, J. S., & Antó, J. M. (1998). Testing the measurement properties of the Spanish version of the SF-36 health survey among male patients with chronic obstructive pulmonary disease. *Journal of Clinical Epidemiology*, *51*, 1087-1094. doi:10.1016/S0895-4356(98)00100-0

Arango-Lasprilla, J. C., Krch, D., Drew, A., De Los Reyes Aragon, C. J., & Stevens, L. F. (2012). Health-related quality of life of individuals with traumatic brain injury in Barranquilla, Colombia. *Brain Injury*, *26*, 825-833. doi:10.3109/02699052.2012.655364

Assumpcao, A., Pagano, T., Matsutani, L. A., Ferreira, E. A., Pereira, C. A., & Marques, A. P. (2010). Quality of life and discriminating power of two questionnaires in fibromyalgia patients: Fibromyalgia Impact Questionnaire and Medical Outcomes Study 36-item short form health survey. *Brazilian Journal of Physical Therapy*, *14*, 284-289. doi:10.1590/S1413-35552010005000015

Augustovski, F. A., Lewin, G., Garcia-Elorrio, E., & Rubinstein, A. (2008). The Argentine-Spanish SF-36 health survey was successfully validated for local outcome research. *Journal of Clinical Epidemiology*, *61*, 1279-1284. doi:10.1016/j.jclinepi.2008.05.004

Ayuso-Mateos, J. L., Lasa, L., & Vazquez-Barquero, J. L. (1999). Internal and external validity of the Spanish versión of the SF-36. *Medicina Clinica*, *113*(1), 37.

Bentler, P. M., & Mooijaart, A. (1989). Choice of structural model via parsimony: A rationale based on precision. *Psychological Bulletin*, *106*(2), 315-317. doi:10.1037/0033-2909.106.2.315

Biesanz, M. H., Biensanz, R., & Biesanz, K. Z. (1999). *The ticos: Culture and social change in Costa Rica*. Boulder, CO: Lynne Rienner.

Blesa, R., Pujol, M., Aguilar, M., Santacruz, P., Bertran-Serra, I., Hernández, G. M., . . . Peña-Casanova, J. (2001). Clinical validity of the "mini-mental state" for Spanish speaking communities. *Neuropsychologia*, *39*, 1150-1157. doi:10.1016/S0028-3932(01)00055-0

Brown, J., Sheffield, D., Leary, M. R., & Robinson, M. E. (2003). Social support and experimental pain. *Psychosomatic Medicine*, *65*, 276-283. doi:10.1097/01.PSY.0000030388.62434.46

Brown, T. A. (2014). *Confirmatory factor analysis for applied research*. New York, NY: Guilford Press.

Castillo-Martinez, A. (2013). Determinantes sociales e inequidades en salud. Una Mirada a la salud en Costa Rica [Social determinants and health inequalities. An insight to Costa Rica's public health]. In Universidad de Costa Rica (Ed.), *La Salud Pública en Costa Rica: Estado Actual, Retos y Perspectivas* (pp. 57-80). San Jose, SJ: Universidad de Costa Rica, Escuela de Salud Publica.

Curran, P. J., West, S. G., & Finch, J. F. (1996). The robustness of test statistics to nonnormality and specification error in confirmatory factor analysis. *Psychological Methods*, *1*, 16-29. doi:10.1037//1082-989x.1.1.16

Der-Martirosian, C., Kritz-Silverstein, D., & Barrett-Connor, E. (2010). Five-year stability in associations of health-related quality of life measures in community-dwelling older adults: The Rancho Bernardo Study. *Quality of Life Research*, *19*, 1333-1341. doi:10.1007/s11136-010-9700-y

Enders, C. K. (2010). *Applied missing data analysis*. New York, NY: Guilford Press.

Failde, I., & Ramos, I. (2000). Validity and reliability of the SF-36 Health Survey Questionnaire in patients with coronary artery disease. *Journal of Clinical Epidemiology*, *53*, 359-365. doi:10.1016/S0895-4356(99)00175-4

Folstein, M. F., Folstein, S. E., & McHugh, P. R. (1975). Mini-Mental State: A practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research*, *12*, 189-198.

Garcia, H. I. G. G., Vera, C. Y. V., & Lugo, L. H. L. A. (2014). Calidad de vida relacionada con la salud en Medellin y su area metropolitan, con aplicacion del SF-36 [Health-related quality of life in Medellin's metropolitan area, measured with the SF-36]. *Revista Facultad Nacional de Salud Publica*, *32*(1), 26-39.

Gomes-Teixeira, T., Alsamir, R., Cunha Nascimiento, D., Sousa da Silva, R., Alves de Almeida, J., Balsamo, S., . . . Prestes, J. (2015). Quality of life and metabolic syndrome in Brazilian women: Analysis of the correlation with aerobic fitness and muscle strength. *Motricidade*, *11*(2), 48-61. doi:10.6063/motricidade.3543

Graham, J. W., Hofer, S. M., & MacKinnon, D. P. (1996). Maximizing the usefulness of data obtained with planned missing value patterns: An application of maximum likelihood procedures. *Multivariate Behavioral Research*, *31*, 197-218.

Graham, J. W., Taylor, B. J., Olchowski, A. E., & Cumsille, P. E. (2006). Planned missing data designs in psychological research. *Psychological Methods*, *11*, 323-343.

Hann, M., & Reeves, D. (2008). The SF-36 scales are not accurately summarised by independent physical and mental component scores. *Quality of Life Research*, *17*, 413-423. doi:10.1007/s11136-008-9310-0

Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, *6*, 1-55. doi:10.1080/10705519909540118

Hu, L. T., Bentler, P. M., & Kano, Y. (1992). Can test statistics in covariance structure analysis be trusted? *Psychological Bulletin*, *112*, 351-362.

Jordan-Marsh, M., Cody, M., Silverstein, M., & Garcia, R. (2008). Assessing a self-report health measure for non-English-speaking elders: Issues in using the SF36 Health survey. *Research on Social Work Practice*, *18*, 55-65.

Jöreskog, K. G., & Sörbom, D. (1996). *LISREL 8: User's reference guide*. Chicago, IL: Scientific Software International.

Keller, S. D., Ware, J. E., Bentler, P. M., Aaronson, N. K., Alonso, J., Apolone, G., . . . Gandek, B. (1998). Use of structural equation modeling to test the construct validity of the SF-36 health survey in ten countries: Results from the IQOLA project. *Journal of Clinical Epidemiology*, *51*, 1179-1188.

Kelly, A., Rush, J., Shafonsky, E., Hayashi, A., Votova, K., Hall, C., . . . Hofer, S. M. (2015). Detecting short-term change and variation in health-related quality of life: Within- and between-person factor structure of the SF-36 health survey. *Health and Quality of Life Outcomes*, *13*, Article 199. doi:10.1186/s12955-015-0395-1

Laucis, N. C., Hays, R. D., & Bhattacharyya, T. (2015). Scoring the SF-36 in orthopaedics: A brief guide. *The Journal of Bone and Joint Surgery: American Volume*, *97*, 1628-1634. doi:10.2106/jbjs.o.00030

Lera, L., Fuentes-Garcia, A., Sanchez, H., & Albala, C. (2013). Validity and reliability of the SF-36 in Chilean older adults: The ALEXANDROS study. *European Journal of Aging*, *10*, 127-134. doi:10.1007/s10433-012-0256-2

López-Pérez, P., Miranda-Novales, G., Segura-Méndez, N. H., Del Rivero-Hernández, L., Cambray-Gutiérrez, C., & Chávez-García, A. (2014). Study of quality of life in adults with common variable immunodeficiency by using the Questionnaire SF-36. *Revista Alergia Mexico*, *61*(2), 52-58.

MacCallum, R. C. (2003). Working with imperfect models. *Multivariate Behavioral Research*, *38*, 113-139.

MacCallum, R. C., Browne, M. W., & Cai, L. (2006). Testing differences between nested covariance structure models: Power analysis and null hypotheses. *Psychological Methods*, *11*, 19-35. doi:10.1037/1082-989X.11.1.19

Martínez-Hernández, L. E., Segura-Méndez, N. H., Antonio-Ocampo, A., Torres-Salazar, A., & Murillo-Gómez, E. (2010). Validación del cuestionario SF-36 en pacientes adultos con asma y rinitis alérgica [Validity of the SF-36 on adult inpatients with asthma and alergic rhinitis]. *Revista Medica del IMSS*, *48*(5), 531-534.

Muthén, L. K., & Muthén, B. O. (1998-2012). *Mplus user's guide* (7th ed.). Los Angeles, CA: Author.

Ngo-Metzger, Q., Sorkin, D. H., Mangione, C. M., Gandek, B., & Hays, R. D. (2008). Evaluating the SF-36 health survey (version 2) in older Vietnamese Americans. *Journal of Aging and Health*, *20*, 420-436. doi:10.1177/0898264308315855

Ohrnberger, J., Fichera, E., & Sutton, M. (2017). The dynamics of physical and mental health in the older population. *Journal of the Economics of Aging*, *9*, 52-62. doi:10.1016/j.jeoa.2016.07.002

Olafsdottir, S. (2013). Social construction and health. In W. Cockerham (Ed.), *Medical sociology on the move* (pp. 41-59). New York, NY: Springer Netherlands.

Oliveira, I., Costa, L., Manzoni, A., & Cabral, C. (2014). Assessment of the measurement properties of quality of life questionnaires in Brazilian women with breast cancer. *Brazilian Journal of Physical Therapy*, *18*(4). doi:10.1590/bjpt-rbf.2014.0045

Palloni, A., & McEniry, M. (2007). Aging and health status of elderly in Latin America and the Caribbean: Preliminary findings. *Journal of Cross-Cultural Gerontology*, *22*, 263-285. doi:10.1007/s10823-006-9001-7

Peek, M. K., Ray, L., Patel, K., Stoebner-May, D., & Ottenbacher, K. J. (2004). Reliability and validity of the SF-36 among older Mexican Americans. *The Gerontologists*, *44*, 418-425.

Phelan, J. C., Link, B. G., & Tehranifar, P. (2010). Social conditions as fundamental causes of health inequalities: Theory, evidence, and policy implications. *Journal of Health and Social Behavior*, *51*, 28-40.

Rosero-Bixby, L., & Dow, W. (2009). Surprising SES gradients in mortality, health, and biomarkers in a Latin American population of adults. *The Journals of Gerontology, Series B: Psychological Sciences & Social Sciences*, *64*, 105-117.

Salas-Chavez, A. (2013). Organizacion de la oferta de los servicios de salud en Costa Rica [Organization of the public health services in Costa Rica]. In Universidad de Costa Rica (Ed.), *La Salud Pública en Costa Rica: Estado Actual, Retos y Perspectivas* (pp. 169-193). San Jose, SJ: Universidad de Costa Rica, Escuela de Salud Publica.

Salazar, R. F., & Bernabe, E. (2015). The Spanish SF-36 in Peru: Factor structure, construct validity, and internal consistency. *Asia-Pacific Journal of Public Health*, *27*(2), NP2372-NP2380. doi:10.1177/1010539511432879

Sánchez, P. H., Ruano, C., Irala, J. D., Ruiz-Canela, M., Martínez-González, M. A., & Sánchez-Villegas, A. (2012). Adherence to the Mediterranean diet and quality of life in the SUN project. *European Journal of Clinical Nutrition*, *66*, 360-368. doi:10.1038/ejcn.2011.146

Simon, G. E., Revicki, D. A., Grothaus, L., & Vonkorff, M. (1998). SF-36 summary scores. *Medical Care*, *36*, 567-572. doi:10.1097/00005650-199804000-00012

Stewart, A. L., & Ware, J. E. (Eds.). (1992). *Measuring functioning and well-being: The medical outcomes study approach*. Durham, NC: Duke University Press.

Sullivan, M. D., Kempen, G. I., Van Sonderen, E., & Ormel, J. (2000). Models of health-related quality of life in a population of community-dwelling Dutch elderly. *Quality of Life Research*, *9*, 801-810. doi:10.1023/A:1008987709788

Taft, C., Karlson, J., & Sullivan, M. (2001). Do SF-36 summary component scores accurately summarise subscale scores? *Quality of Life Research*, *10*, 395-404.

Tucker, G., Adams, R., & Wilson, D. (2013). Observed agreement problems between sub-scales and summary components of the SF-36 version 2: An alternative scoring method can correct the problem. *PLoS ONE*, *8*(4), e61191. doi:10.1371/journal.pone.0061191

United Nations Developmental Program. (2017). *2016 human development reports*. Retrieved from http://hdr.undp.org/en/2016-report

Ware, J. E., Jr. (1999). SF-36 health survey. In M. E. Maruish (Ed.), *The use of psychological testing for treatment planning and outcomes assessment* (pp. 1227-1246). Mahwah, NJ: Lawrence Erlbaum.

Ware, J. E., & Gandek, B. (1998). Overview of the SF-36 health survey and the International Quality of Life Assessment (IQOLA) project. *Journal of Clinical Epidemiology*, *51*, 903-912.

Ware, J. E., & Kosinski, M. (2001). Interpreting SF-36 summary health measures: A response. *Quality of Life Research*, *10*, 405-413.

Ware, J. E., & Sherbourne, C. D. (1992). The MOS 36-item short-form health survey (SF-36): I. Conceptual framework and item selection. *Medical Care*, *30*, 473-483.

Wiech, K. (2016). Deconstructing the sensation of pain: The influence of cognitive processes on pain perception. *Science*, *354*, 584-587. doi:10.1126/science.aaf8934

World Health Organization. (n.d.). *What are social determinants of health?* Retrieved from http://www.who.int/social_determinants/sdh_definition/en/

World Health Organization. (2004). *Promoting mental health: Concepts, emerging evidence, practice: Summary report*. Geneva, Switzerland: Department of Mental Health and Substance Abuse in collaboration with the Victorian Health Promotion Foundation (VicHealth) and the University of Melbourne.

Yiengprugsawan, V., Welsh, J., & Kendig, H. (2018). Social capital dynamics and health in mid to later life: Findings from Australia. *Quality of Life Research*, *27*, 1277-1282. doi:10.1007/s11136-017-1655-9

Zhang, X., Xia, R., Wang, S., Xue, W., Yang, J., Sun, S., & Zhuang, G. (2018). Relative contributions of different lifestyle factors to health-related quality of life in the elderly. *International Journal of Environmental Research and Public Health*, *15*, 256. doi:10.3390/ijerph15020256

Zhang, Y., Qu, B., Lun, S., Guo, Y., & Liu, J. (2012). The 36-item short for health survey: Reliability and validity in Chinese medical students. *International Journal of Medical Sciences*, *9*, 521-526.

Zuniga, M. A., Carrillo-Jimenez, G. T., Fos, P. J., Gandek, B., & Medina-Moreno, M. C. (1999). Evaluacion del estado de salud de la encuesta SF-36: resultados preliminaries en Mexico [Health assessment using the SF-36: preliminary results in Mexico]. *Salud Publica de Mexico*, *41*, 110-118.

Zunzunegui, M. V., Alvarado, B. E., Beland, F., & Vissandjee, B. (2009). Explaining health differences between men and women in later life: A cross-city comparison in Latin America and the Caribbean. *Social Science & Medicine*, *68*, 235-242. doi:10.1016/j.socscimed.2008.10.031